

Preserving the Past While Embracing a Sustainable Future: Rehabilitation of the Historic King Street Station

**Trevina Wang, LEED AP,
Seattle Department of
Transportation
Seattle, WA**

**Tim Williams, LEED AP
ZGF Architects LLP
Seattle, WA**

**Peter Alspach, PE, LEED AP
Arup
Seattle, WA**



Constructed in 1906, King Street Station, once a gateway for millions of travelers coming into Seattle, Washington and the Pacific Northwest, played a major role in establishing Seattle as a major metropolitan city. But the station had fallen into disrepair with the decline in train travel in the latter half of the century.

Currently under construction, the rehabilitation and seismic upgrade of the station is meant to restore the original character of the historic station, strengthen its role as a multi-modal transportation hub and neighborhood landmark and serve as a catalyst for additional redevelopment within the neighborhood. Reinforcing the urban presence and long-term viability of King Street Station, a nationally listed historic landmark and transportation pioneer, not only ensures the mobility of the region for future generations, but also underscores the importance of preserving history and greening existing building stock and transit infrastructure.

The project's thoughtful sustainable design and planning strategies can be applied to related transportation and historic preservation projects:

REHABILITATE HISTORIC FEATURES

Elements of the project include rehabilitation of the iconic 12-story clock tower, original 35-foot-high ornamental plaster ceilings and walls, terrazzo and mosaic tile floors and operable windows. True to the building's original fashion, the white marble wainscoting, decorative sconces and glass globe chandeliers that were removed during 'modernization' of the station in the 1950s will be replicated and replaced where possible.

A major part of the historic rehabilitation involves restoring the 105-year-old original old growth Douglas-fir windows and returning them to operable condition (many of which had been painted, nailed or caulked shut). The design team, together with the historic preservation consultant, took a detailed survey of the building's 26 different window types, the character defining features, specific window elements and their condition to determine an itemized list of tasks to repair or replace the existing windows.

MATERIAL CONSERVATION AND REUSE

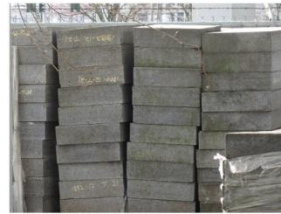
Because of the station's landmark status, the design team was already tasked with rehabilitation and reuse of original materials wherever possible, which has the additional benefit of reducing waste and minimizing new material use. When original materials were beyond repair or had been removed and lost in earlier projects, salvaged materials and creative reuse of existing building materials were prioritized. Where new materials were required the specific products were thoroughly investigated based on renewable or recyclable content, durability, cost and ability to compliment or replicate the original architecture and detailing of the station.

A number of material conservation strategies were applied including:

- Harvesting original brick from any of the required demolition activities, including the 1950s escalator addition, for use on areas that require infill or patching as part of the exterior facade repair
- Rehabilitating and re-using copper fascia that was removed from original canopies during previous renovations and stored on-site, as well as remaining copper fascia on the canopies that was covered with layers of peeling paint
- Re-using marble harvested throughout the building to patch and repair marble wall coverings in the main public spaces
- Salvaged and reused previous building foundation granite block for repair of the station façade
- Acquired salvaged glass tiles for the clock tower glass pyramid repair
- Removing the drop ceiling to uncover and restore original plaster ceilings and balconies overlooking the main waiting hall
- Saving and restoring historic building finishes such as the waiting room terrazzo floor, plaster ceilings and detailing
- Recycling over 98% of construction waste



Drop ceilings will be removed to reveal original ornate plaster ceilings and balconies



Salvaged Granite Slabs



Repair Original Brick and Mortar Facade



Original Copper Fascia
(covered with peeling paint)



Original Copper Fascia
Stored On Site

SEISMIC AND STRUCTURAL UPGRADES

The rehabilitation also includes significant seismic and structural updates to improve the building's safety, durability and longevity – all which comply with the City's sustainable building standards and the Secretary of the Interior's Standard and Guidelines for Historic Preservation.

Poorly maintained and allowed to deteriorate over the last century, the rehabilitation will bring the King Street Station up to modern codes and standards while retaining the historic character-defining qualities. The project is one of the first to comply with the City of Seattle's new code for Seismic Rehabilitation of Existing Buildings (ASCE 41), which allows for a project-specific, site-specific response to structural upgrades in lieu of the standard code-defined responses.

The design team took advantage of this new code flexibility, coupled with the building's location in a liquefaction zone and unreinforced masonry perimeter bearing walls, to supplement rather than

replace the station's existing structural system (which has performed remarkably well in several significant seismic events).

Because of the historic nature of the building, the vast majority of the added structural support elements needed to be carefully inserted behind existing historic finishes. With only three inches between the historic finishes and the wall to insert the system, the standard reinforcement approaches were not possible or desirable. Thus, a combination of anchors, wide flange sections and horizontal steel plates were inserted into existing walls around the entire perimeter of the station's three main floors. Additionally, to reinforce the station's foundation, a combination of steel helical piles and grade beams were added along with a structural collar to the outside of the building to help contain the building foundations while saving the historic terrazzo floors in the public areas.

Another challenge was reinforcing the 12-story clock tower on top of the building, which was not structurally connected, while minimizing load requirements on the historic public waiting area below. The team was able to transfer loads from column grid to column grid with steel beams, plates and enhanced floor diaphragms.

With these seismic upgrades, the landmarked King Street Station will be fortified to withstand both 500 year and 2500 year events and preserved for future generations.

IMPROVE ENERGY PERFORMANCE

After quickly determining that the antiquated equipment used to heat the station was extremely inefficient (cooling was nonexistent), and inconsistent with the historic building, the design team conducted cost-benefit analysis to determine the most effective and minimally invasive mechanical system to meet energy performance goals and the project budget.

A ground-source heat pump system was selected, but initial funding only allowed for 37 geothermal wells (which would provide all of the building's heating and cooling needs). The design team took advantage of the structural work on Jackson Street Plaza to put 37 geothermal wells under the building, to allow for additional wells to be added in the parking lot if funding became available. Since then, SDOT received a grant for additional geothermal wells (there are now 68 total) which are anticipated to supply 100% of the building's HVAC depending on the tenant fit out. Mechanical space is allocated for a

future boiler and fluid cooler, which are not anticipated to be needed unless occupant loads greatly exceed those anticipated.

The total projected energy savings associated with the mechanical and geothermal upgrade translates into a reduction of 206 metric tons of CO₂ per year. This represents an extraordinary savings over pre-retrofit operation on a per square foot basis. The pre-retrofit active area of building (13,383 sf) was using 118 KBTU/sf/yr. When renovations are finished, the complete building active area (totaling 64,334 sf) will have an EUI of 38 KBTU/sf/yr, a 68% reduction in energy use in a space more than 4 times its original size.

Additionally, energy models predict the overall building to perform 56% better than ASHRAE 2007 and to meet the current benchmarks of the 2030 Challenge.

King Street Station

Energy performance against various benchmarks

Existing building

118

kBtu/SF/yr

LEED baseline (ASHRAE 2007)

86

2030 Challenge target

(60% reduction from similar existing buildings or 40% reduction from ASHRAE 2007)

52

Modeled design

38

RESTORE NATURAL VENTILATION

The interior environment of the station will be optimized for users through restored and enhanced natural ventilation capabilities that provide high indoor air quality as well as thermal comfort. Because the station was originally designed to be naturally ventilated and restoration of the historic windows is part of the project scope, the design team explored local climate conditions to confirm the use of natural ventilation (consistent with historical performance) where possible to improve energy efficiency, human experience and serve as a model for other buildings.

On site air quality testing was conducted around the station, particularly around the waiting room operable windows, to monitor the collective effect of pollutants from trains, roads, loading docks and other

vehicular traffic. Tests showed that the ambient air quality meets the ASHRAE Std. 62.1 requirements for outdoor air quality, allowing a naturally ventilated scheme to be pursued to create a comfortable and healthy indoor environment. .

Local climate research and analysis was conducted with local wind data, cloud cover data, and typical meteorological year (TMY3) data to determine anticipated conditions.

Thermal comfort levels were established for different areas of the building based on accepted temperature ranges, also taking into account outdoor temperatures and area functions to ensure occupant comfort. Because of thermal expectations in today's marketplace, natural ventilation was limited to the public waiting space (23% of the occupied portion of the building), which posess a wider thermal acceptance range due to its function as 'temporary' waiting area. Mechanical cooling will only be provided in the naturally ventilated public waiting space when the outside temperatures rise above 80°F.

To effectively implement this strategy, the restored historic window actuators in the public waiting areas will be restored and electronically controlled by the building automation system to meet ventilation requirements monitored by CO2 sensors as well as cooling requirements measured by thermostats. Actuators are required due to the public nature of the spaces that limit personal control as well as the physical location of the windows, which are generally inaccessible due to height.

FACILITATE CONNECTIONS

Planning leverages the historic rehabilitation of the building and its location in a vital urban core to enhance sustainable transportation and facilitate better connections between the community and city. King Street Station serves as a multi-modal transportation hub in a vital urban core, accommodating trains, light rail, streetcar, bikers and pedestrians. The sustainable rehabilitation of the historic station is designed to knit together disparate neighborhoods and districts to re-establish the original development patterns of the historic Pioneer Square neighborhood which was built around walking, biking and public transit. A mixed-use tenant component on the upper floors is part of this strategy to help increase establish the station as a destination and help create a vibrant and active community.

To facilitate better pedestrian connections between the Jackson Street and King Street levels, an original exterior public staircase (which was closed off for an interior escalator addition in the late 1950s) will be repaired to physically re-link the two levels and currently disconnected neighborhoods, and provide a public pedestrian pathway and way finding between the street levels.

Jackson Street Plaza



ENHANCE URBAN PRESENCE

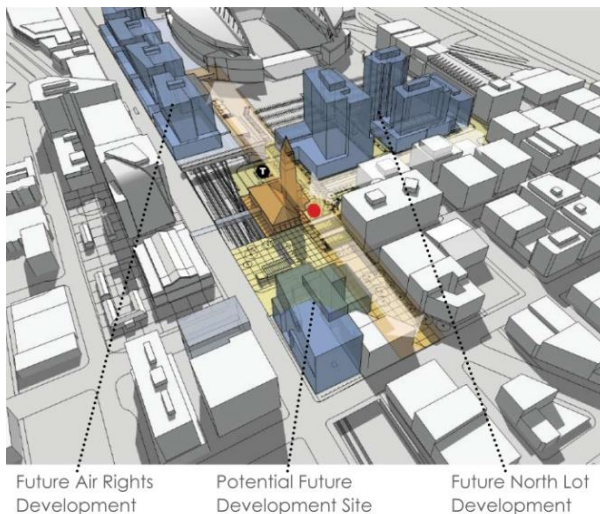
The rehabilitation makes environmentally and fiscally conscious improvements to increase and improve the use of King Street Station and create an active vibrant community center.

The following improvements are planned to enhance the urban fabric of the neighborhood:

- Re-establish historic development patterns focused pedestrian and transit friendly neighborhoods
- Repair, restore, clean or replace (as needed) of the brick facade and terra cotta detail to improve the building's face to the community
- New overhead canopies to provide weather protection and create inviting building entries
- Remove existing parking in front of the building to allow for plaza space to accommodate outdoor tables and seating for a future cafe
- Architectural lighting to highlight historic features of the building
- Convert existing Jackson Street Plaza from a parking lot to a landscaped public open space to create a textured pedestrian environment and flexible open space for community events and activities
- Future tenant use of the second floor to further activate Jackson Street Plaza

- New passenger drop-off / pick-up location and turnaround on King Street to help manage vehicles and traffic and improve pedestrian access
- Existing walkways to be widened and repaved to create a pedestrian-friendly forecourt
- New lighting, site furniture, street trees and wayfinding signage to welcome travelers and visitors
- Incorporate materials sensitive to the historic nature of the station and surrounding neighborhood

Positioned at the nexus of two historic neighborhoods (Pioneer Square and the International District), and in near proximity to two professional sports stadiums (NFL and MLB), the rehabilitation is also being acknowledged as the catalyst for public and private redevelopment in the neighborhood which includes an envisioned 500,000 SF mixed-use, residential community on the adjacent “North Lot”, as well as more than 3 million SF of office, mixed-use development using the air rights over the station’s tracks (which are currently being explored by interested parties).



LEASABLE TENANT SPACE

The renovation provides mixed-use leasable space on the second and third floors for potential commercial tenants to attract development revenues and enhance the station’s appeal to transportation users and the community. Tenant spaces will be upgraded to meet code and prepared to a ‘shell and core’ state, in order to accommodate specific tenant needs as the spaces are leased.

Ideal tenants will share a commitment to preservation, stewardship of the natural environment, and a desire to promote dense, transit-oriented urban development. The design team is helping develop tenant guidelines outlining proper and environmentally responsible tenant actions for future fit-out and use of the office spaces.

PHASED AND LONG-TERM PLANNING

Logical and prudent strategies for phased development can restore historic facilities while also accommodating future developments. Early collaboration between the project team (including the architect, contractor, green building consultant, historic consultant, engineers, owner, owner’s representative and building tenant) allowed the team to outline long-term goals and embed them in the scope of work from the outset of the project. This clear early direction allowed work to be phased in order to capitalize on funding as it becomes available and accommodate future development, technologies and modes of transit.

The creation of a long-term ‘Urban Vision’ alongside the station rehabilitation outlined additional future enhancements to the facility, adjacent neighborhoods and open space outside of the rehabilitation scope.

LEVERAGE FINANCING OPPORTUNITIES

The design team worked with the station’s owner, city agencies, and private developers to identify the unique opportunities presented by the historic transit station to create:

- Potential financing opportunities for the restoration and rehabilitation of historic transit facilities, bringing together public agencies and private investors while also securing unique funding and development strategies
- Concepts for current and future investment resulting in millions of square feet of surrounding adaptive reuse and new commercial development
- An integrated plan that encouraged a broadening of the understanding of the potential opportunities for development in the immediate station area.

CONCLUSION

“On track” to receive a LEED Platinum Certification, the rehabilitation of King Street Station balances historic preservation and sustainability goals to achieve a high-performing multi-modal transit station, from energy, operational and human perspectives. The project serves as a model for future transit developments that strive to capitalize on the value of transit infrastructure, the expansion of neighborhood services and the inherent value of reusing an existing structure.

PROJECT TEAM

Owner: Seattle Department of Transportation
Architect: ZGF Architects LLP
Owners Representative: Shiels Obletz Johnsen, Inc.
GCCM: Sellen
Structural Engineers: ARUP/Coughlin Porter Lundeen
Mechanical/Electrical/Plumbing Engineers: ARUP
Historic Consultant: Artifacts, Inc.
LEED Certification: Green Building Services, Inc.
Geotechnical Engineer: Hart Crowser, Inc
Civil Engineer: KPFF Consulting Engineers, Inc
Acoustic: Sparling
Lighting: Pivotal Lighting Design
Commissioning Agent: Keithly Barber Associates

DIAGRAM OF SUSTAINABLE FEATURES

